THE

Mutations of the Seas:

OR,

A Manifeſt Reaſon given for all the

MUTATIONS

Obſerved in the

SEAS.

AND THIS

By ways ſo Natural, Plain, and Eaſie, that every man may underſtand the Manner, and muſt conclude it to be ſo.

By JOHN BRIANTSON.

LONDON:

Printed by *George Larkin* in *Scalding Alley* in the *Poultrey*. 1683.


BIBLIOTHECA BODLEIANA

To the READER.

Reader,

IN the following paper you have the Solution of one of the greateſt Secrets in Nature, a manifeſt reaſon given for all the Mutations obſerved in the Seas, and that by ways ſo natural, plain and Eaſie, that you and every man may underſtand the manner, and muſt conlcude it to be ſo. As firſt, A reaſon is given why we have two Tides upon all ſhores in 24 hours. Secondly, *Why thoſe Tides fall exactly ſo many Minutes later every day, as the Moon doth.* Thirdly, *By what meanes theſe Tides are made to Increaſe & decreaſe every ſeven days & why they are always higheſt when the Moon is in Conjunction or Oppoſition with the Sun, and loweſt when in a Quadrature, or 90 Degrees diſtant.* Fourthly, *The true cauſe why the Spring-tides are higher in* March *and* September *then ordinary And Fiftly, Why upon ſome ſhores the waters riſe to a very great height, when on Neighbouring ſhores they are hardly diſcernable, with other Obſervations about the Flux and Reflux of the Seas. And all theſe ſeemingly different motions of the Seas ſolv'd by one moſt eaſie, ſimple, and before (for any thing I know) unthought-of motion of the Earth. But now I muſt tell you that I am a Seaman, and then method and order will not be expected; being rarely found amongſt men of my Profeſſion; and I ſhall not ſcruple to confeſs, that I have had ſome trouble to patch it up as it is, finding by this little tryal, that tho men unlearned may ſometimes think of ſuch things as theſe not unſucceſsfully, yet they ſhall not without a great deal of trouble and diſadvantage be able to communicate their thoughts to others, as you may too plainly ſee by this; but (I hope) in a little time you may ſee what is here wanting made good by an able pen. In the mean time I have promiſed you much, and with more then uſual Confidence, perſwading my ſelf that the hopes of being made acquainted with this great Secret, will engage you to take a little pains more then ordinary to underſtand my meaning, which if you once do, you and I ſhall quickly be agreed; you will then ſay that you know the true cauſe of the Ebbing and Flowing of the Sea.*

To the READER.

If you think that I have made more words then needed about some things, impute it to my fear that otherways I should not be understood, or to my Ignorance not knowing the most expressive words, the shortest way. If in other things I am as much or more too short, be so kind as to excuse me by thinking what your self would do in the same case; and in this I am sure you will be of my mind, that is, that he that knows he does not speak well, should say as little as he can. And upon that account I have not troubled you, nor concerned my self with any thing that I could any ways avoy'd.

Amongst many other defects you will find that my Ignorance in the Mathematicks, as well as other parts of Learning, has forc't me instead of Terms of Art (which would have been much better understood) to make use of such Words and Terms as being known to me, I thought might best express my thoughts to others: perhaps you will think that a very little time and pains in that Study might have enabled me to have set this off much more advantagiously, I am of the same mind, but the circumstances I stand in have not yet afforded me that time. But I tell you again, you shall find the thing it self to be true, and then surely you will not be angry with me for these things For if a man should tel me that he would presently bring me to a place where lay un-own'd & before Concealed Treasure, if now the way he led me was none of the cleanest, & withal much about, & incumbred with Bryars and Thorns, yet if at last he put me in possession of the promis'd and much desir'd Riches, I would certainly, by acknowledging the kindness, prevent his making Excuses for not staying to inform himself better in the way before he undertook to be my guide. The same upon the same Conditions is expected from you, by

John Bryantson.

The

The Mutations of the Seas:

OR,

A Manifeſt Reaſon given for all the Mutations obſerved in the Seas.

THE Arguments brought by Learned Men to prove that the Earth may have Motion has ſo far prevailed, that it will not be look'd upon as an Extravagancy now to aſſert it; So that I do not fear but that the Motion I ſuppoſe the Earth to have (when well conſidered) will willingly be admitted; for if it may have any, it may have this. But becauſe the Motion and *Hypotheſis* upon which it is founded, is altogether new; it will (I think) be convenient, to endeavour to leſſen a little (if I can) the ſtrangeneſs of it to prevent your throwing the Paper by as a raſh and wide conjecture, before you underſtand my meaning. For I queſtion not but that you will be ſupriz'd when you ſhall hear me ſay, that the Moon and Sun give the Earth Motion, as they are carried round our Globe, but content your ſelf, and in two or three hours time (if you have but patience to read ſo long, and be not altogether a Stranger to the Heavenly Motions) you will find the Motion I ſuppoſe the Earth to have to be ſo far from any thing you have yet heard or fancied to your ſelf, and ſuch agreeableneſs between that and the Motions of the Seas, that what but juſt before you thought ſtrange, if not fabulous, you will then think not only eaſy but reaſonable.

In the mean time you may conſider that the Tides keep ſuch equal pace ſo exactly obſerve the Motions of the Moon, (even to a minute of time) that no wit or reaſon of man is able to exclude the Effects of that Planet. It is moſt certain,

certain, (and very wiſe and Learned men in all Ages, have been compelled to acknowledge it) that the Moon by ſome ſecret vertue muſt give the Seas motion. So that the matter may ſafely, be brought to this ſhort Iſſue, one of theſe two things muſt of neceſſity follow: Either the Moon muſt at the ſame time move the Seas all over the World, and the Earth be yet immovable; Or elſe give the Earth motion, and by that means, at the ſame time univerſally move the Seas.

Now if all thoſe Learned men that have aſſign'd the Soveraignty of the Seas to the Moon (upon the conſidera ion of the manifeſt agreement that is found to be between the Motions of the Ocean and that Luminary) have thought it not impoſſible for the Moon to give the Seas Motion; Why may it not be thought at leaſt as poſſible for the Moon to give the Earth motion, and by conſequence at the ſame time univerſally move the Seas? As at the ſame time to move the Seas all over the world, and let the Earth ſtand ſtill. And ſo much the rather, ſince it is certainly true, that Nature in all her opperations makes uſe of the moſt facil and ſimple means. For take a Boat, ſet the head and ſtern North and South, place in this Boat 15 or 20 veſſels of water, now if you ſhould bid one to move the water in all thoſe veſſels at the ſame time with a conſtant regular motion, you would think him no wiſe man, if he ſhould attempt to do it any other wayes than by giving the Boat motion. Nay he could not otherwayes do it without a great deal of help. But if with one hand onely he ſhall lift up the ſide of the Boat a little, and then depreſs that ſide as much below the level as before he rais'd it, and ſhall for ſome time continue thus to move it from Eaſt to Weſt, and Weſt to Eaſt; he ſhall with as much eaſe, and at leaſt with as conſtant a motion, at the ſame time move all the waters in all thoſe veſſels, as he can by any other wayes move all the water in any one of them. So it muſt be confeſt that the Moon by onely giving the Earth (the containing veſ-

(ſe

ſel) motion, may at the ſame time, and with as much eaſe move all the waters in the *Indian*, *Atlantick*, *Paciſſick*, nd all other Seas, as by any other ways, or means that may or can be thought of, move all the water in any one of thoſe Seas.

Beſides, Nature commonly makes uſe of ſome inward Principle, for opperations that are to be conſtant and regulat, as the motions of the Seas are known to be; but if it ſhould be granted that the Moon might by ſome occult quallity, ſome unknown Principle, give the Seas motion, and the Earth be yet immovable, the difficulty would remain; for no ſatisfactory reaſon has or can be given, how by any influence or opperation the Moon may or can be ſuppoſed to have upon the waters ſhould cauſe thoſe different viciſſitudes that are found in the Tide of the Seas. Then if the appearance cannot be ſolv'd (as in truth they cannot) by any influence the Moon may or can have upon the Waters. And that the ſame mutations muſt of neceſſity enſue upon the motion of the Earth, and that it is as poſſible for the Moon to move the Earth and Seas together, as to move the Seas alone, and beſides much the more facil and ſhorter way, why ſhould it appear ſo ſtrange a Paradox to affirm that the Moon gives the Earth motion? Nay who can doubt but that the Moon by ſome inward Principle gives the Earth motion? And then you ſhall have this advantage into the bargain, that you ſhall not be to ſeek for a Principle; for the Magnetick vertue or force of attraction upon ſolid Bodies has been long known; And you cannot deny the Earth to be a Magnetick Globe, except you will deny that to be in the whole, which more or leſs is manifeſtlyto be ſeen in almoſt every part, but moſt wonderfully in the Load-ſtone which is apart of the true Primary and integral ſubſtance of the Earth.

Now ſince there has alwayes been acknowledged to be a very great Affinity between the Moon and Earth, and likeneſs of parts, I think the Moon may reaſonably enough be

concluded to be ſo too; And then theſe two great Magnates hanging in the thin Air, muſt eaſily admit of motion, ſo that I cannot ſee where the difficulty ſhould be, or what ſhould hinder but that the Moon may give the Earth, and the Earth the Moon (if the Moon may be thought to have need of it) motion. If you ſhall think the diſtance too great, conſider that if a ſmall Loadſtone will give a Librated Needle a very ſwift motion at the diſtance of ſix or ſeven foot, or more, what diſtance may be thought great enough to give bounds to the Attractive Vertue of Load-ſtones ſo immenſly great as the Tereſtrial Globe and Moon. And beſides it is not improbable but that the Moon may conſiſt of ſuch parts, that the Appetite and Deſire of Union may be much greater between the Earth and Moon, then between the Loadſtone and Iron. Nay who can tell but that the more, in ten parts of this our Globe may be indewed with a much more powerfull attractive vertue then any piece of ſtone yet found, or perhaps that may be found upon or near the ſurface of the Earth.

I ſhall add, that though perhaps the excellent uſe that is made of the Load-ſtone in Navigation may ſeem to ſome men ſufficiently to anſwer the ends of its Creation, yet it cannot be denyed but that the World was grown Old before the uſe of it was known; ſo that Nature may be ſaid to have indued the Magnet with thoſe admirable Vertues, from the beginning of the World till within a few years laſt paſt, to no purpoſe (for I think there was little uſe made of it before) But now if you ſhall look upon the Terreſtrial Globe and the reſt of the ſuperior Bodies, to be nothing elſe (as it is certain that the Earth is nothing elſe) but great Magnates or Load-ſtones, you cannot think but that wiſe Nature lodg'd theſe wonderfull vertues in them for far more wonderful uſes, and that it would be unreaſonable to think that thoſe vertues have not been kept in Exerciſe ever ſince the Creation. And you ſhall not need to trouble your head to think how, for you ſhall be forc't to acknowledge that, by

his

this Magnetick Vertue the Earth and Seas have alwayes been kept in motion. Then if you consider the many Benefits that we enjoy (which we could by no means want) by the daily Tides you must confess it to be a very wonderful work of Providence, and that as the same has been from the Beginning, so it must continue so long as the Sun and Moon indure.

And then if those Bodies called Planets be Magnetick Globes or Worlds (as surely that man never thought it worth his pains to consider whether or no they might not reasonably enough be esteemed so, or else his Understanding must be yet in its leading strings that thinks otherwise) and inhabited, then such a Motion as I suppose the Earth to have will be necessary for them too; which they may very well have, for *Mercury* and *Venus* (which are but the Sun's Moons) may give the Sun, and the Sun them motion. And the like Friendly Offices may mutually pass between *Jupiter* and *Saturn*, and the Stars orMoons that move about them. And Neighbouring Stars may give *Mars* motion. Onely there must be difference in the mutations that shall happen in their respective Seas, in point of time, as well because some of them have more Moon's, as that some of those Moon's take more some less time in discribing their Circles then our Moon about our Globe, *&c.*

But further 'tis very probable that by the force of Attraction all those Mundan Bodies not onely keep their first designed distances, by having a dependancy upon each other, but describe their several Circles. And then men need not vex themselves with thinking what matter the Planets Orbs consist off, for they may safely take their determinate courses through the Fluid Air without any danger of loosing their way or interfearing on with another, and too besides much labour might otherwise be sav'd, but enough and perhaps to much of this.

The Earth then being a Magnetick Globe or Loadstone, it's certain that the same vertues that are in the Loadstone,

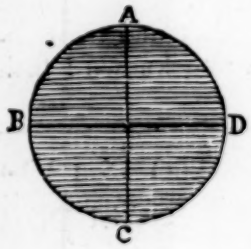
are and must of necessity be much more powerful in the Earth. Now amongst many other vertues truly admirable in the Magnet these following are well known to be peculiar to it. First, That every minute particle of a Loadstone will constantly look with its determinate parts towards the same and determinate parts of the Universe. Secondly, That the force of the Magnet is sent by infinite right lines through the Stone, the principle vertue residing in the middle, the more remote from the Centre, the more faint and weak the vertue. Thirdly, That the greater Stone draws, more forceably than the less, the compass of it's vertues or of its Activity is greater.

force

Let these faculties be supposed to be (as they certainly are) in the Earth it will then be requisite to fix those lines and points of Attraction. Now I know that a Loadstone or piece of Iron toucht with a Stone) librated with a thred or any other way: so that it be left at liberty to move, will presently direct it self and point North and South, but the Stone in this way respect the Poles of the Universe, for it is known that the Needle varies. direction in the same place, as here at *London*, sometimes Easterly sometimes Westerly in a certain period of time; and this cannot be in respect of the Poles of the Earth. And (I think) none has been so curious as strictly to Examen whether or no the Poles of the Stone had their Position North and South in the Mine, so that perhaps it might be their East and West; for the Earth being at liberty to move in the yielding Air, and its Poles of equal force (as the Poles of no piece of Stone are and being with equal force drawn by either of the Poles of the Universe, it may be direct its self to neither of them but to a point equally distant between them, that is East and VVest. As we see that two Loadstones placed at a convenient distance North and South from a Needle, shall draw that Needle that before would willingly alwayes point North and South to point, now East and VVest and is the same as if those Loadstones were in those Poynts. More

might

might be ſaid to countenance this, and perhaps you will think much more againſt it, let it be ſo for I could as willingly as any man, for reaſons that it may be have not been thought off by many, let the Poles keep the places alwayes. Aſſign'd them but when you ſhall know upon what grounds I have been perſwaded to think that the Earth has Eaſt and VVeſt Points of Attraction, you will find that I have reaſon for it, nay you will think that it muſt be ſo, And then you may take your liberty to judge, whether it may with more reaſon be thought that the Poſition of the Poles in the Terreſtrial Globe is indeed Eaſt and VVeſt. Or letting the Poles be North and South, The Earth may yet be endued with ſome ſuch-like Magnetick attractive vertue in certain and determinate Eaſt and weſt Poynts (if it may be thought to have any attractive force in fixt Eaſt and Weſt Points it will ſerve me. Then without more ado, I will now ſuppoſe that infinite right lines of attraction (like as in the Magnet) run through the Earth from Eaſt to Weſt as in the Figure.



Where let A. B. C. D. be the Terreſtrial Globe, A, C. the Meridian B. D. the Horizantal lines, thoſe leſſer lines Infinite lines of Attraction runing through the Earth from Eaſt to Weſt, the Horizantal line to cut the Equator at 140. and 320 Degrees of Longitude, and the Meridian at 50. and 230. And now the Globe being by the Meridian Line A. C. devided into two Hemiſpheres, I ſhall call them the Eaſtern and Weſtern Hemiſpheres, or the Eaſtern and Weſtern Points of Attraction; and the Points D. B. where the moſt forceable Vertue reſides the Centre of thoſe Points of Attraction. And now if you pleaſe ſuppoſe ſuch lines and Points in the Globes of the Moon and Sun, which being granted and the

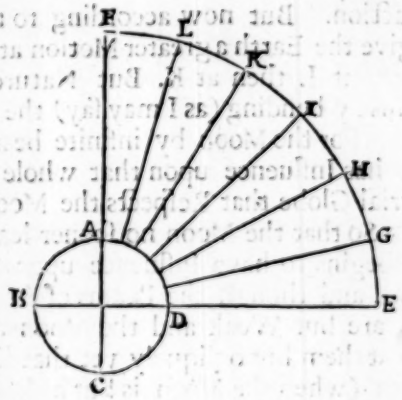
Earth

Earth poiz'd in the flin'd Air with Equal Reſpect to the Eaſt and Weſt as well as North and South points of the Heavens.now though the Earth thus ballanc't would immutably keep its ſelf directed with its determinat parts towards the ſame and determinate parts of the Univerſe, yet that it may and does eaſily and Willingly admit of Motion, and that I may come to the buſineſs I do now affirm that this our Globe is kept in Perpetual motion from Eaſt to Weſt, and Weſt to Eaſt every ſix hours (do not ſtartle becauſe I ſay the Motion is for ſix hours from Eaſt to Weſt, for it may very well be ſo though you have not yet taken notice of it) by a Powerfull Magnetick Vertue in the Moon and Sun as they are carried round the Earth. And upon this Hypotheſis without introducing the leaſt Novelty all the Mutations obſerv'd in the Seas ſhall be manifeſtly reſolv'd and muſt of Neceſſity inſue, But to render what I ſhall ſay leſs perplext I ſhall ſpeak as if the Moon alone (being in this much more Powerful) gave the Earth Motion, there being no need to take notice of the Sun till I come to ſhew you by what means the Motion of the Earth is abated and increaſt every ſeven days, and then I ſhall examin what Intereſt the Sun has in the Action, this being known I ſhall now tell you

After what manner the Earth is moved ſo as to make two Tides upon all Shores in 24 hours.

LET the Earth be in its Centre and the Moon in the Horizon Eaſt it is certain that now the Moon cannot by any Magnetick Vertue give the Earth Motion except it ſhould be in a direct Line, which cannot be, for now the Moon is in the Centre of all thoſe Lines of Attraction in the Eaſtern Hemiſphere of the Earth and ſo muſt have the ſame Advantage of giving the Globe Motion from weſt

to East, as from east to west, but as the Moon advances above the Horizon, she at the same time by a very easy gentle Motion Attracts or lifts up the eastern side of the Globe, or if you will give the earth Motion by turning it a little in the Centre from east to west, continuing and increasing the Motion as she rises for three hours, that is till the Moon is South-east, And then and at all other times when she is equaly distant between the Horizontal and Meridian Lines she gives the earth the greatest Motion. The Reason why I say the Moon gives and Increases the Motion of the earth as she rises above the Horizon is plain, for take a Globe, set it upon its Poles, and Ballance it so that it may allwayes have a Tendency, the same way; now if you shall fix a Line in the Horizon, As in this Figure.



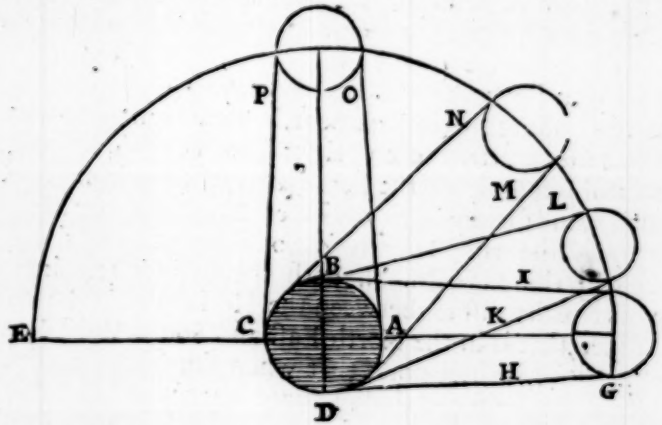
Where let A. B. C. D. be the Terestrial Globe, A. C. the the Meridian, B. D. the Horizontal lines, *E. F.* the Orb of the Moon, G. H. I. K. L. Line drawn at every 15 degrees, between the Horizontal and Meridian Lines in the Terestrial Globe to the same Points in the Moons Orb. If you shall now attempt to give the Globe Motion by plucking

ing

ing at any of theſe Lines, and keep your hand to the ſame Point in the Moons Orb it will be in vain, for you ſhall not give it Motion from eaſt to weſt, or the contrary. But if plucking By the line *E.* you ſhall hold your hand, as high as G. in the Orb of the Moon, you will eaſily give it a little Motion from eaſt to Weſt. And if you ſhall yet carry your hand higher to H and I plucking yet by the Line *E*, you ſhall in uſing but the ſame or leſs Strength give the Globe a greater Motion at H then at G. and I. then at H. So the Moon in the Horizon, cannot give the earth Motion, but as ſhe riſes above it ſhe ſucceſſively every moment drawn by lines more upright (I know not what other Name to give them) from the Centre of the Point of Attraction, or from all thoſe Lines or Points that from all parts of the eaſtern Hemiſphere of the Terreſtrlal Globe dart out Rays of Attraction. But now according to this Rule the Moon ſhould give the Earth a greater Motion at K then at I and greater yet, at L then at K. But Nature has wiſely provided for this by bending (as I may ſay) the Moon forces againſt her ſelf. For the Moon by infinite beams, or Rays of Attraction; has Influence upon that whole Hemiſphere of the Terreſtrial Globe that Reſpects the Moon in her Diurnal Motion. So that the Moon no ſooner leaves the Horizon but ſhe begins to have Influence upon the Weſtern ſide of the Globe and though the Beams of Attraction near the Meridian, are but Weak and the Moon at a great diſtance Glances at them but oqliquely yet that litale Impediment is enough (when the Moon is but a little above the Horizon (where ſhe could not if this Obſtruction were not give the Earth but very little motion) to keep this motion from being either ſudden, or great, and that now and at all times it may be moſt eaſie, conſtant, and Regularfor as the Moon in Riſing above the Horizon, has every moment greater Advantage of giving the Earth Motion, So the Influence ſhe has

has upon the Contrary ſide of the Globe is every moment greater, but yet notwithſtanding this the Motion is increaſt till the Moon is 45 Degrees above the Horizon.

I know what I have ſaid is obſcure enough, and I doubt I ſhall make it but little plainer by a Figure, however I will venture though very unartificially as before.



Let A. B C. D. be the Terreſtrial Globe, A.C. the Horintal B. D. the Meredian Lines.—Thoſe Leſſer Lines infinite Lines of Attraction, E. G. the Moon's Orb, H. I. K. L. M. N. O. P. Lines drawn from the Eaſtern and Weſtern Poynts of Attraction in the Globe of the Moon, to different Poynts in the Terreſtrial Globe. Now ſuppoſing the Moon in the Horrizon; and then ſhe draws by the Lines H I. (you may imagine innumerable Lines of Attraction more either from the Moon to the Earth, or from the Earth to the Moon; 'tis the ſame thing for Magnetiſme muſt be from a propenſion or mutual inclination in both Bodies) the Moon in this place can give the Earth no Motion (for as I ſaid before) ſhe is now in the Centre of the Poynt of Attraction, and ſo can give the Earth no Motion; But about an hour after this the Moon

will

will be 15 degrees above the Horizon, and then she draws by the Lines K. L. Now you may observe that the Line L. reaches 15. degrees West from the Meridian, and then the Moon must have influence upon all those Western Points of Attraction that are between that Poynt and the Meredian. And on the contrary the Line K. Terminates in a Poynt 15. degrees West from the opposite Poynt of the Meredian, so that the Moon can have no influence upon all those Eastern Points of Attraction that are between the Termination of the Line K. and the Meredian. But the Magnetick vertue being weak in Poynts so remote from the Centre, the Moon notwithstanding this impediment, by the advantage of drawing by Lines a little more upright from all those other more powerful Poynts gives the Earth a little Motion from East to West. And for the same reason continues and increases the Motion as she rises till she is South East; and then she draws by the Lines M. N. both these Lines terminate in Poynts equally distant between the Horizantal and Meredian Lines, that is in the North East and South West Poynts of the Globe, where note, that when the Moon comes to be vertical to either of those Poynts she gives the Earth as great a Motion as she does at the Poynt she is now in. So that now the contest is at the highest, for though the Moon here is more advantageously plac't to give the Earth Motion from East to West, then at any time since she appeared above the Horizon, yet the advantage she has gained upon the Western-side of the Globe, is now so great that here the motion of the Earth is Arrested so that as the Moon from this Poynt moves towards the Meredian the Earth declynes again, for as the Moon in rising above the Horizon gradually increast the motion of the Earth till she was South-East, so now after the same proportion it is abated as the Moon from the South East moves towards the Meridian. The nearer the Moon aproaches the Meredian the more advantage she has of drawing from the Western Poynt of Attraction, and just so much

much as ſhe gains upon that ſide ſhe muſt loſe upon the contrary : ſo that the Earth now muſt move back again from Weſt to Eaſt, and by the ſame eaſie degrees as it was raiſ'd returns to its place, as all other Magnetick Bodies do, when that which forces them from their deſigned Stations or deſired places, is either removed to ſuch places as renders it leſs powerful or altogether ineffectual. But to proceed.

The Earth now has had but three hours motion from Eaſt to Weſt, nor will it ever have a greater motion then now from Eaſt to Weſt, or the contrary; yet hereafter the motion will conſtantly be ſix hours from eaſt to weſt, and from weſt to eaſt: for obſerve that the firſt three hours of the motion is alwayes that three hours time in which the Earth is returning to its place from which the Moon before had made it vary. As now all the time the Moon is moving from the South-eaſt to the Meridian, the Earths motion (for the reaſon before ſaid) will be back again from Weſt to eaſt; and when the Moon has reacht the Meridian, then will the Earth be at its Level, and juſt as it was ſix hours before, when the Moon was in the Horizon, for now the Moon being equally plac't between the points of Attraction, draws by the Lines O. P. and ſo muſt have the ſame advantage of drawing from the one as from the other. But now though the Earth be at its Level, yet the motion ceaſes not, for as you can no ſooner ſay the Moon is in the Meridian, but that ſhe is out of it again, ſo this Motion is not interrupted for a moment of time. The Moon no ſooner leaves the Meridian, but by the ſame eaſie motion that ſhe rais'd the eaſtern-ſide of the Globe, ſhe now attracts and turns up the Weſtern ſide, and by that means continues the motion from weſt to eaſt, till ſhe is South-weſt; for the Moon muſt gain juſt as much Advantage as ſhe moves Weſt from the Meridian till ſhe is South-weſt, by approaching every moment nearer the Weſtern Point of Attraction, and being further removed from the contrary; as ſhe loſt for the ſame reaſon, in moving

from the South-eaſt, to the Meridian. Then now the earth has had ſix hours motion from weſt to eaſt, for it began three hours before the Moon reacht the meridian, by letting fall the eaſtern ſide of the Globe, and was continued till the moon was three hours paſt the meridian, by turing up of the contrary ſide. And now the motion will be back again the next ſix hours from eaſt to weſt, for look how much advantage the moon gained by drawing by lines ſucceſſively more upright as ſhe moved from the Horizon to the South-eaſt, ſo much ſhe now muſt loſe by drawing by lines more declining as ſhe moves from the South-weſt to the Horizon. So that as the moon from the South-weſt declines towards the Horizon, the motion of the Earth muſt be back again from eaſt to weſt; and when the moon ſhall be in the Horizon, then will the earth be at its Level, and juſt as it was when the moon was in the oppoſite point of the *H*eavens. But now as when the moon was in the meridian the motion ceaſes not, for the moon without the leaſt ſtay draws down the weſtern ſide of the Globe, and after the ſame manner and for the ſame reaſon continues the motion from eaſt to weſt, for ſix hours, that is, till the moon is three hours beneath the Horizon or North-weſt: The ſame order is obſerv'd as the Moon moves round the Globe, for the next ſix hours the motion will be back again from weſt to eaſt.

If I have not expreſt my ſelf ſo as to make you maſter of my thoughts, take a Loadſtone made Spherical, ſet it upon its Poles, and carry another with a very eaſie motion in a Circle round it, and you may ſee (I doubt not) this motion very exactly, and as the ſaying is, to the life repreſented. And that you may not think me ſo much wanting as wholly to neglect a tryal, you may know that when I had well conſidered the excellent agreement between the motion of the Earth (as I had ſuppoſed it) and the Seas, It came preſently in my mind that by making a light Globe, and ſetting it upon its Poles ſo tenderly ballanc't that it might but juſt

have

have a Tendancy the ſame way, I might inform my ſelf by the help of a Loadſtone, which would admirably ſuppply the moons place, by drawing by inviſible lines what motion the ſtone, carried in a circle round the Globe, would give it, and how it would agree with the motion I had ſuppos'd the earth to have, but unexpected and ſucceeding troubles kept me at leaſt three years otherways imploy'd; but then I made a Globe about ſeven Inches in Diameter, with three ſmall Oſier Hoops, repreſenting the Equator, Horizantal, and meridian lines, through the Centre of this; from eaſt to weſt, I fixt an Axis of ſuch Wyer as Mariners, Needles are made of, and upon the ends of the VVyer (which did but juſt appear through the Hoops) I Riveted two thin pieces of Iron (each about an Inch long) pointed. I carried this Globe to a mathematical Inſtrument-maker that was maſter of a ſtone (for I had none of my own) and upon tryal found that holding the ſtone either in the eaſt or weſt points, or meridian-line, it gave it no motion (which I never doubted) but if it varied never ſo little from thoſe points, either from eaſt to weſt, or the contrary, it gave the Globe motion accordingly; but for want of an Arch to keep the ſtone in all points at the ſame diſtance from the Globe, I could not preciſely obſerve at what point between the Horizontal and meridian lines, it had its greateſt motion, which was the chief thing I made the tryal for. But the Satisfaction I received by this, made me reſolve upon a ſecond, with a Globe more artificially made, but unwelcom accidents have kept me from an opportunity to this day. If any man ſhall think it worth his trouble, I doubt not but that he may adjuſt ſuch a Globe as I have been ſpeaking of, ſo as to repreſent this motion exactly enough; Only let the Equator be made in all parts of an equal weight, for that that I made was ſo heavy in the Eaſt and Weſt points, that when the ſtone came near the Meridian, the Globe would decline with a motion ſomewhat too quick, except I held the Stone very near, and then it carried the Globe round with it. Its not to be queſtioned but,

That this Motion of the Earth muſt make two Tides upon all Shores, every 24 hours, or in the ſpace of time the Moon is moving round our Globe.

AS before, let the Moon be in the Horizon Eaſt, and this to be the firſt time of her going round our Globe the Earth and all Seas now without motion, When the Moon takes her firſt ſteps above the Horizon ſhe at the ſame time gives the earth Motion by turning it a little in the Centre from Eaſt to Weſt, this muſt cauſe an inequality in the ſurface of the water, and that preſently produces a motion; ſo that now the *Indian*, *Atlantick*, and *Paciffick* Seas firſt begin to move, and at the ſame time take their courſe Weſt, the waters leaving the now higher weſtern, and failing upon the lower Eaſtern Shores, and this Motion is continued till the Moon is South-Eaſt, and then is it high-water and the firſt flood upon all Eaſtern & low-water and the firſt Ebb upon all Weſtern Shores. Now this Tide was but three hours for it wanted three hours from a preceding motion, but hereafter every Tide will be exactly ſix hours. For now as the Moon from the South-eaſt moves towards the Meridian, the Earth returns to its level, moving back again from Weſt to Eaſt; and now all Seas take their firſt journey Eaſt, leaving the Eaſtern and falling upon the forſaken Weſtern Shores; and when the Moon has reacht the Meridian, then will the Earth and Seas be at their firſt level, but now the Motion ſeakes not, for as the Moon in her never-ceaſing motion leaves the Meridian and haſtes away to the Weſt, ſo the motion of the Earth and Seas Eaſtward is continued for three hours longer,

that

that is, till the Moon is South-west, the Moon giving the Earth just as much motion now from East to West; then this Tide was exactly six hours. And now the Seas will take their course West again, for as the Moon from the South-west declines towards the Horizon she lets fall the Western side of the Globe, and then all Seas haste away to wash and fill the empty Eastern Shores. And this motion is continued till the Moon is 45 degrees beneath the Horizon, or North-west, and then it will be high-water, and the Second flood upon the Eastern; and low-water, and the second Ebb upon the Western Shores. The next six hours the motion of the Earth and waters will be back again from West to East, that is till the Moon is North-east, and then will they have had two floods upon the Western and as many Ebbs upon the Eastern Shores. And when about three hours after this, the Moon shall be in the Horizon, that is, the same point of the Heavens she was in when the motion began, then shall the Earth and Seas be at their Level, the waters being just as high upon all shores now as then. But though the waters now are neither higher nor lower upon the shores then when the motion began, yet now it will be called half Flood upon the eastern, and half Ebb upon the Western shores, for that three hours before by a preceeding motion of the Earth, the waters were so much higher upon the latter, and so much lower upon the former, then they were 24 hours before. Then the three hours Flood and Ebb that was then wanting upon those shores, is now made good. So that in the space of 24 hours there has been two compleat Tides upon all Shores.

This is an order establisht by Nature, plain and without Mystery, its but a gentle Rocking of the Earth in the Centre from East to West, and west to east, and though it may be hard to say precisely how much motion from east to west, or the contrary, the Moon gives the earth, yet without troubling your head, you may conclude it to be very little; for let it be supposed that upon indifferent shores the water, rises

ten

ten foot (which yet is more then ſome will allow) five foot of this is not to be accounted for, the firſt three hours of every Flood is but the return of the ſame water that by a contrary motion of the Earth firſt fell from thoſe Shores. For if the Earth was to keep its Level without motion, the waters would be conſtantly as high upon all ſhores as they are when we ſay it is half flood or Ebb, abating but ſo much as by the advantage of falling upon ſhores that have a ſmooth and eaſie aſſent, or into Bays that open with wide mouths and after are contracted into narrow Corners, or for ſome other manifeſt cauſe they are made to mount. Now then what motion can you imagine the earth to have to be little enough to ſwell the waters five, nay ten foot upon thoſe ſhores where the Seas are two or 3000 miles or more over, as they commonly are; I am in the mind you will ſay, (and you may ſafely do it) that this motion muſt be ſo little as to be almoſt altogether inſenſible. So that though I have made a great many words about it, and talkt of ſix hours motion, from eaſt to weſt, and weſt to eaſt, yet when you have well conſidered the matter, you may (without any Prejudice to your Judgment) very well ſuppoſe the Earth always to have had this motion, though you knew it not. As ſhall be abundantly confirmed to you by all that follows, for,

---

The Moon giving the Earth this Motion, the Tides muſt fall exactly ſo many Minutes later as the Moon doth.

THe other Motions of the Seas may as well be thought to depend upon the Motion of the Sun as Moon; but in this the Moon ſeems to have all the ſway, and has ſo far outrivald

rivald the Sun, that men in all ages have willingly assign'd the Empire of the Ocean to the Moon, upon the account of the most exact agreement that is found between the Moon and Seas in this Motion of Retardation, which is thus: The Moon comes later to the same point of the Heavens one day with another by about forty eight minutes, and the Tides observe the same. When the Moon is in Conjunction with the Sun, it is always high water at *London-bridge*, at three a clock, but now the same Tide will fall later every day as the Moon doth, so that when the Moon is in Quadrature with the Sun, the same Tide will fall six hours later, that is, at nine a Clock; And so every seven days the same tide will fall later by six hours till the Moon is in Conjunction again, and then the same Tide will fall out at three a clock as before. If the Moon comes later to the same point of the Heaven, 10, 15, or 20 Minutes this day (as it sometimes falls out so) then the day before, the Tides observe the same all the World over; and that so precisely, that no rule can be given to know the time of high-water but by knowing the true time of the Moons coming to the South. And which is more, if strong winds keep back or accellerate the Tides (as oftentimes it happens) half an hour or more, yet the very next Tide (if it be a calm) shall observe the due time, it should have done, notwithstanding this interruption. Then the question may well be askt whether or no the Seas Universally may be made thus exactly to keep time with the Motion of the Moon by any other ways or means whatever then by the motion of the Earth; but no man can doubt but that if the Moon gives the Earth motion after the manner that I have supposed it, but that the Seas must observe the same even to a minute of time: For if the Moon shall be South-east, South-west, North-west or North-east, (at which points the Motion of the earth and seas from East to West, or West to East always begins) this day at 12 a clock, if to morrow the Moon comes later to these points 20 or 30 minutes, its certain that the Motion of

the

the Earth cannot begin till then, and by conſequence it muſt be high water ſo many minutes later. This is ſo manifeſt, that to ſay more would be needleſs. And therefore I ſhall now let you know

---

By what means the Motion of the Earth and Seas are abated and increaſed every ſeven days.

I Said before that the Moon and Sun by a powerful Magnetick attractive Vertue gave the Earth Motion. I ſhall now add, That by reaſon of the exceeding ſwift motion of the Moon, the Sun ſometimes comes to be ſo poſited as directly to oppoſe the Moon in the Motion, and ſometimes to aſſiſt with all his forces. But that you may the better underſtand what I ſay, and at the ſame time fancy to your ſelf, how much the Sun contributes to, or impedes the Motion as he comes to be every day diverſly poſited, I will now examine how much the Sun may be concerned in the Action, which may eaſily be gathered from this, That when the Moon is 90 degrees from the Sun, the Sun then directly oppoſes the Moon in the Motion; and yet then the Tides here at *London* commonly riſe about 12 foot. At new and full Moon the Sun lends his utmoſt Aſſiſtance, and then they riſe about 16 foot, now if when the Sun directly oppoſes the Moon, the tides riſe 12 foot, and whenhe aſſiſts with all his forces they riſe but 16. its certain that if the Sun did neither hinder nor aſſiſt, the Moon alone would give the Earth ſo much motion as ſhould conſtantly make the Tides riſe here 14 foot: So that the Suns intereſt can be but as two to 14. I do not pretend to be preciſe in this, for perhaps there may be (eſpecially at ſome times of the year) more then four foot difference between the Neap and ſpring Tides here, and it may be the Neap

and

and Spring Tides riſe not commonly ſo high as I ſpeak of; but this is not ſo far from the Truth, but that it may ſerve to make a pretty near Eſtimate; Then now if you Underſtood after what manner I ſuppos'd the Earth was movd, and at what points it had it's greateſt Motion, You will eaſily know how that motion comes to be abated or increaſt, which is thus

Suppoſe the Moon in the Horizon Eaſt, and in Conjunction with the Sun this day, then the Tides muſt be at the higheſt, for now the Moon and Sun being carried round the Earth in the ſame Point, they with their United forces muſt give it as great a motion as at any time they can; For the next day, it will be three quarters of an hour later before the Moon reaches the Horizon; and then the Sun will be about 12 degrees above it: So that this day when the Moon ſhall be South-eaſt (the place of greateſt advantage of giving the Earth motion) the Sun will be 12 degrees nearer the Meridian, at which point the Sun cannot altogether ſo powerfully aſſiſt the Moon, as the day before when they were both at the ſame time in the South-eaſt Point; So that this day the motion of the Earth is a very ſmall matter abated. And for the ſame reaſon the Motion every day abates, till the Moon is in the quarter; For about three days after change, when the Moon ſhall be in the Horizon, the Sun will be 45 degrees above it, then this day all the time the Moon is moving from the Horizon to the South-eaſt, the Sun is moving from the South-eaſt to the Meridian; in all which points, eſpecially near the Meridian, the Sun but faintly aſſiſts the Moon, and in the meridian not at all. But the next three days the Sun does not only leſs aſſiſt, but every day more then other oppoſes the Moon in the motion; For about five days after Conjunction, when the Moon ſhall be in the Horizon, the Sun at the ſame time will be about 60 degrees above it; Then this day when the Moon is South-eaſt, the Sun will be declined 12 degrees Weſt from the meridian: So that all the time the Sun was moving from the meridian to that point, The Sun oppoſed

the Moon, by drawing from the contrary point of Attraction. The next day the impediment will be greater, and when the Moon ſhall be in the quarter, or 90 degrees from the Sun, then will the Sun directly oppoſe the Moon all the time of the motion: For then when the Moon is in the Horizon, the Sun muſt be in the Meridian; ſo that all the time the Moon is moving from the Horizon to the ſouth-eaſt, the Sun is moving from the meridian to the ſouth-weſt: and ſo directly oppoſes the Moon with all his forces; The Sun having in all thoſe points the ſame advantage of giving the earth Motion from Weſt to Eaſt, that the Moon has of giving it motion from Eaſt to Weſt: now if the Sun did attract with equal force, the Earth muſt this day be without motion; but the Moon (by reaſon of her nearneſs) being much more powerful, gives the Earth motion, notwithſtanding this Oppoſition. Then now the Tides are at the loweſt, the Earth having now the leaſt motion it can at any time have. For now for the ſame reaſon that the motion was abated from the Moons being in Conjunction till ſhe was in the firſt quarter, it will now be increaſt till ſhe is in Oppoſition. The next day after the quarter, when the Moon ſhall be in the Horizon, the Sun will be 12 degrees Weſt from the meridian; then this day when the moon ſhall be ſouth-eaſt, the Sun will be declined 12 degrees from the ſouth-weſt, at which point the Sun cannot ſo much impede this motion as the day before. And now every day the Impediment will be leſs, and accordingly the motion of the Earth and Seas will be increaſt, but eſpecially three days before the moon comes into Oppoſition, for then the Sun does not only leſs oppoſe, but for ſome part of the time (every day more then other) aſſiſts the moon in the motion. And when the moon ſhall be in oppoſition, the motion will be the ſame it was when in Conjunction; for then when the moon is in the Horizon eaſt, the Sun will be in the Horizon Weſt; and as the moon riſes above the Horizon, and gives the Earth motion from Eaſt to Weſt, the Sun at the ſame

time

time declines beneath the Horizon, and assists the moon in the motion altogether as powerfully as when in Conjunction. As the moon attracts or turns up the eastern side of the Globe, the Sun at the same time pulls down the VVestern side, which is the same thing as if they had been both in the same point, and the motion will be as great, and the Tides as high, as at the new moon, The same order is observ'd till the moon comes into Conjunction again, for as the motion was abated from new moon to the first quarter, so now for the same reason and after the very same Proportion it will again be abated till the moon is in the last quarter, and then increast as before for the next seven days, &c.

Now let any man that takes pleasure in these things consider well with himself how much every day the motion of the earth ought to be abated or increast, (allowing the Sun to have such an interest as I spake of before) and I dare promise him all the satisfaction in it can be expected; for upon Examination he shall find the increasing and decreasing of the Tides to corrospond as exactly with it as he can desire, and much more excellently then I can express it. Three Days before new and full moon, you shall find the sun very aptly plac't to assist the moon in the motion, and acordingly you will find the Tides to increase. Three days after new and full moon the sun not much less assists the moon (tho every day less then other) then upon the same day, and then you will find the Tides to decrease but leisurely. Three days before either of the quarters, you must think the sun notably impedes the motion, the Tides then decrease a pace. Three days after the quarter, the Tides increase but slowly, the sun those days less opposing, but not at all assisting the moon. There is yet a fourth motion of the seas; that is,

That these Spring Tides are made to increase and decrease every quarter of a year.

THis motion of the Seas has not I think been much taken notice of here, only Learned men have observ'd that the spring Tides are usually higher in *March* and *September*, then ordinary. But in the Mediteranean Sea it has been known long since, that the spring Tides are constantly lower when the Sun is in either of the Tropicks, and higher when in the Equator; and he that shall observe it upon any shore that lies open to the Ocean in any part of the World, (I believe) will find it so; but this place is by no means fit for these inquiries, for in *December* Land-floods many times makes the Tides higher then usual, at other times they are pestred with Ice, and that keeps them back, besides strong winds at Sea often makes the Tides higher or lower then Ordinary, when perhaps its calm here. And then in *June*, tho the spring Tides are lower then then usual, yet it has been thought to be only for want of fresh water coming down so plentifully as at other times; and indeed reason and Experience tell us that when Land-floods happen at the new or full Moon, the spring-tides must be and are then higher then at that time of the year they are accustomed to be; and by Consequence when the Rivers are empty, the Tides must be and are then lower. But then its well known that the waters in *European* Rivers are usually lower in *September* then in *June*, and yet the spring-tides are then commonly highest, but by reason of the aforesaid frequent Interruptions this has not been taken notice of, though its discernable enough

enough here to a curious obſerver. And the Reaſon why the ſpring-tides are higher at theſe times then Ordinary, is very plain, and may in a few words be diſpatcht. For ſuppoſe the Moon to be in Conjunction with the Sun in the firſt degrees of *Cancer*, they now in their diurnal motion deſcribe the leaſt Circle (except when in *Capricorn*, and then it is the ſame) about the Earth; and then muſt give the Earth the leaſt motion. This you cannot queſtion, for if you were to give a Wheel motion upon its Axis, you would not lay your hand upon the Nave, or near it, but upon the Rim, the greateſt Circle, ſince you might with uſing but the ſame ſtrength at the Rim give it a greater motion then in any leſſer circle. 'Tis the ſame with the Sun and Moon, about 14 days after this, the Sun will be in the middle of *Cancer*, and the Moon about the middle of *Capricorn* in Oppoſition with the Sun, (which is the ſame thing as if they were in the ſame circle) and deſcribe circles ſo much greater, and by that advantage give the Earth a greater motion, ſo that this ſpring tide muſt be a little higher then that that happened 14 days before. And ſo every time the Moon ſhall be in Conjunction or Oppoſition with the Sun, they will yet deſcribe greater circles, and by that means give the earth a greater Motion; and accordingly the ſpring-tides will increaſe till the Sun has reacht the Equator. And then being carried directly over the Body of the Earth in the greateſt circle, they muſt needs be thought to give the Earth and Seas the greateſt motion. So that now the ſpring-tides are at the very higheſt; for now they will for the ſame reaſon decreaſe again, till the Sun is in *Capricorn*, and the next quarter increaſe, *&c.* And this without doubt is the only cauſe why the ſpring-tides are higher in *March* and *September*, and lower in *June* and *December*.

I have endeavoured to inform my ſelf how much the ſpring-tides are higher when the Sun is in the Equator, then when in the Solſtices; and by the neareſt Obſervation I could make here at *London*, there is the difference

ference of near two foot, but I am not so well satisfied in it as I desire.

It will not be amiss to give you notice here that you shall hardly meet with two men that agree at what time the Spring Tides are at the highest (I mean those Spring Tides that happen at New and Full-Moon) some saying upon the day the Moon is in Conjunction or Opposition, some the next day, others will have it the third Tide after, by which it should seem the time is not fixt. I am in the mind that for one half of the year the Tides may increase a day or more after Full and Change, but not the other half; That is, from *June* to *September*, and from *December* till *March*; my reason for it is this, in these quarters the Sun is returning from the Tropicks to the Equators, and then though the Sun a day after full and change do less assist the Moon in giving the Earth motion then upon the day; yet it is so very little less, that the disadvantage is more than recompenc'd by the Moons discribing the day after (having a very swift motion) a greater Circle about the Earth. As the Sun goes from the Equator to the Tropick, it is quite contrary; for then the day after full and change the Moon describes a lesser Circle than the day before; and then the Tides should not increase after New and Full-Moon, at least not so long.

I have made some agreeable observations about this, but have not had time for a strict inquiry; though I have long thought of it. Those that live near this, or any other River that Ebbs and Flows, may eafily inform themselves whether this be so or no.

But now besides these alterations of the Seas, it must follow upon this motion of the Earth: first, that when the Tides rise highest, they must fall lowest; Secondly, That the Tides in all Seas must set East and West; and Thirdly, That the motion of the Seas must begin at the same time all over the World.

The first of these you may at your pleasure observe, and you

you ſhall alwayes find that the higheſt ſpring Tide makes the loweſt Ebb. And all experimene'd men know the Tides ſet directly Eaſt and Weſt upon all the utmoſt Eaſtern and Weſtern Shores in the World. And I think that Learned men are agreed, that the motion begins at the ſame time in all Seas. Thus much is certain, that when the Moon is South-weſt, or in the oppoſite Point of the Heavens, that is North-eaſt, it is alwaies high-water upon all the utmoſt ō-pen weſtern Shores of *Europe* and *Affrica*, from *Nova Zembla* to the Cape of *Good-hope*. And that when the Moon is South-eaſt or North-weſt, it is high-water upon the utmoſt Eaſtern Shores of *America*. So that when it is high-water upon the firſt named, it muſt be low-water upon the other Shores. When they have the firſt of Ebb upon the Weſtern Shores of *Europe* and *Affrica*, they muſt have the firſt of Flood upon the oppoſite Eaſtern Shores of *America*. By which it is plain that the motion begins at the ſame time in all theſe Seas; and that what we call the Ebbing and Flowing of the Sea, is nothing but the falling of the waters from off the Weſtern, upon the Eaſtern Shores, and the ſame back again every 6 hours. But further, when it is high-water upon the Weſtern Shores of *Europe* and *Affrica*, it is high-water at the ſame time upon the Weſtern Shores of *Italy*, and upon the Shores of *Syria* at the bottom of the Mediteranean Sea, and (take good notice of it) when it is high-water upon theſe Shores, it is low-water at *Venice* and on the contrary. Now this I take to be a very forceable argument to prove the motion of the Earth, as I have ſuppoſed it, and then the motion muſt begin at the ſame time in all Seas; for it is unconceivable how this ſhould otherwiſe happen: but if you ſhall fancy the Terraqueous Globe to have a little motion from Weſt to Eaſt, you will then ſay that it muſt make high-water upon all the firſt named *Shores*, and low-water at *Venice*. But then let the Eaſtern ſide be turned up, and it muſt make high-water at *Venice*, and low-water upon all the other Shores.

The instances that may be taken out of this and other Seas to confirm this motion of the Earth, are every where so many and so obvious, that they cannot escape your notice if you will but take the least pains to inquire into these things. Nor can you (I think) meet with any thing that shall seem to contradict it. A reason now should be given,

---

Why upon some Shores they have almost no Tides, when upon others they have great and almost incredible Floods.

I Will onely name some of those places that are most remarkable for great Tides, or the contrary, without attempting to give a reason why it is so, being almost confident that when you have observed those places well, you will say that the Earth having such a motion, it must of necessity be so. I will begin in the North parts of *Europe*, In some Bays upon the Shores of *Nova Zembla*, it Flows 12. or 14 foot, but in some places upon the Neighbouring Shores of *Lapland* they have no Tides at all; and where they have most which is (as I remember) near the Bay of *St. Nicholas*, one two, or three foot. *Pet* and *Jackman* searching for a passage by the North-east to *India*, found the waters in some of the Bays upon this Coast to be black, and like a standing Pool, without Motion. Note that there are Bays upon those Shores that have the same Forms that those have upon the other Shores where they have very great Tides. Upon the Western Shores of *Norway* about 10 or 12 foot, but upon the Southern Shores, of *Norway* they hardly exceed one foot or two; in the *Baltick Sea* no Tides. In the *Bay* of *Bristow* 50 foot. At the Town of *Orange* in *Normandy*, they rise somemes

80 foot. In the Bay of *Biſcay* 18, 20, or 24 foot. Upon the Weſtern ſhores of *Affrica* 10, 12, or 14 foot. But upon the Southern ſhores of *Guiney* and *Benin* they have very little Tides, every ruffling Gale of Wind diſorders them in many places there. In *Davis's* ſtreight (in ſome places near the Entrance) it flows about 30 foot, At *Port-Nelſon*, (which lies oppoſite to the mouth of the *Streights*) where Sir *Thomas Button* Wintred, 15 foot: but in the South-part of the ſame Bay, where (as I take it) *Hudſon* Wintred, but one foot, obſerve this Bay well. In the Bay of *Foundy*, North-ward from *New-England*, which place I had never heard ſpoken of for great Tides, (though I had been twice in North-*America*) but about two or three years ſince I ſaw a draught of the Sea Coaſts thereabouts deſcribed in very large form, where this Bay was repreſented in ſuch a Figure that I concluded that if the Earth had ſuch a motion as I before had ſuppoſed, that then in this Bay there muſt be great Tides. Not long after I met with a Maſter of a Ship that traded into thoſe parts, who upon my asking told me, that it flow'd there 12 or 13 fathom, but becauſe I knew the man to be one that lov'd to make things that were ſtrange ſeem wonderful, I did not rely upon his Teſtimony, but inquir'd of others, who agreed that it flow'd there above 60 foot; I now and alwayes mean ſpring-tides; and in Bays or mouths of Rivers; for where the Land is not indented, the waters never riſe ſo high. In other Bays upon the Eaſtern ſhores of North *America*, two or three fathom; upon the Eaſtern ſhores of South-*America*, 10 or 12 foot, according to the largneſs of the Seas, which are there very unequal. And becauſe this may be a rule for other places, you may obſerve that from *Cape Frio* (which is in the ſouth-eaſt parts of *Braſile*) to the *Streights* of *Magallan*, the Land trenches away ſouth-weſt. Now when the firſt of flood falls upon the ſouth-eaſt ſhores of *Braſile*, the waters riſe conſiderably higher upon the ſhores, (as they do upon all other ſhores) then the ſurface of the Sea at a very little diſtance is, now the waters that next fol-

low these, not finding it easie to mount this height, and yet being prest forwards by succeeding waters, are part of them forc't to follow the trenching of the Land at a distance from the shore. So that if in all this Tract of Land any Promontory or Head-land that juts it's self farther into the Sea then ordinary, to catch or Arrest these waters in their passage, happens to lie on the Western-side of any Bay or mouth of Rivers, the Tide in those Bays or Rivers shall be proportionably higher; but if the Land on the Eastern side be strecht farther out then the Tides in those Bays or Rivers, will accordingly be abated. It Ebbs and flows up the River of *Plate* (says Mr. *Purchas*) an 100 miles. In the River *Galegos* near the entrance of the *Streights*) and upon the shores of *Fuego* it flows 60 foot. In the Bay that lies between the City of *Martaban* and *Pegue*, in the Gulf of *Bengalia* in *India*, the Tides set in with a great deal of fury, and are said to rise there sometimes 40 foot. In the Bay of *Cambaja*, great Tides, but they rise not so high, nor is the motion so violent as in the former: In the Red-Sea very little Tides: What Tides they have upon the shores of New *Guiney*, I cannot learn, but without doubt very notable in that great Bay, upon the western-shore. The greatest Tides in the Mediteranean Sea, are said to be upon the Coast of *Syria*, where (I think) they rise seven or eight foot. At the bottom of the Gulf of *Venice*, 5 foot; upon the Western shores of *Italy*, not above a foot: The Waters run through the streight of *Sylla*, and *Caribdis*, six hours East, six hours west, with a great deal of violence, without rising or falling, or but very little; the like happens between all the Islands in this Sea, only the course of the waters is not so rapid, the passage not being so streight.

Now take a Globe, set it upon its Poles, the Horizon to cut the Equator at the points before spoken of, and look upon any of these places, or any other place that you know; or that Report has made famous for great Tides, or otherways; and if the place be upon a Western shore, as the Town of *Orange* in *Normandy*, then imagine the

Globe

Globe to have a little motion, (you had beſt fancy it to be exceeding little indeed, and your ſelf not near, or elſe the very fear of being overwhelm'd with the falling Waters that muſt be crowded into this place, will make you tremble) from Weſt to Eaſt, but if the place be upon an Eaſtern ſhore, as the Bay of *Foundy*, then from Eaſt to Weſt; and the reaſon why theſe things are ſo, will appear ſo manifeſtly, that it muſt be delightful to conſider it; but it would add to the Pleaſure, if you had the Figures of thoſe places you had a mind to Examine, deſcribed in the largeſt Forms.

Take Notice, that in all thoſe places where I have ſaid there is great Tides, that the bottoms of thoſe places are ſandy and ſmooth; which may indeed Contribute to the raiſing of the Waters there, but cannot ſo properly be ſaid to be the cauſe of the extraordinary Tides in thoſe places; As the great Tides are the cauſe of that; for where ever the Tides ſets with a direct Courſe into the mouths of Bays or Rivers, they muſt have there alwayes ſandy ſmooth Bottoms. Except in large Bays or Rivers that have narrow Mouths, and in them the quite contrary may happen; for the greateſt ſwelling of the Waters ſhall be near the Entrance, and leaſt of all in the Extremities of thoſe Bays; and they may have very uneven Bottoms, *&c.*

In a word, there is nothing of Myſtery in theſe things; Nothing but what is Conſonant to the Laws, Principles, and Ordinary workings of Nature, and moſt agreeable to Reaſon, nothing but what you may imitate, and at your pleaſure ſee exactly repreſented (what alterations happens upon the account of Rivers excepted) by placing in a Boat (as I ſaid before) 10 or more Veſſels of Water, of different ſizes and Figures; let one of thoſe Veſſels be long and very narrow, and ſtand as the Boat North and South: Now make a mark upon the Weſtern ſide of any of thoſe Veſſels, even with the Surface of the Water, and then in three Mi-

nutes time lift up the Eaſtern-ſide of the Boat ſo high till you raiſe the water half an Inch above that mark; and then in the like Space of time as you rais'd it, let it return to its place, and (without letting the motion ceaſe) in three Minutes more depreſs that ſide as much below the Level as before you raiſed it, that is till the water be fallen half an Inch below that Mark upon the Weſtern ſhore; and now in other ſix Minutes raiſe it to its firſt height, and if you ſhall continue thus to move it, you ſhall conſtantly give the Boat ſix minutes motion from Eaſt to weſt, and from Weſt to Eaſt, and it will be ſaid to Ebb and Flow upon that ſhore where you made the Mark, a full Inch. And you ſhall have two Tides upon al ſhores every 24 Minutes; and you may make thoſe Tides to fall later by three quarters of a Minute every 24 minutes, and to increaſe and decreaſe in what Periods of time you pleaſe. Nay if a Hand, a Sun, on the contrary ſide of the Boat, did ſometimes hinder, ſometimes aſſiſt you, the Motion of the Boat and Waters muſt be abated and increaſt accordingly; or if you ſhould remove your hand 23 degrees on either ſide of the Equator (if I may ſo call it) of the Boat, you ſhall not in uſing but the ſame Strength give the Boat ſo great a Motion at the greateſt Declination as in the middle the greateſt Circle; and if you have the Figure of thoſe ſhores deſcribed in ſome of theſe Veſſels, where they have very great or almoſt no Tides, you ſhall ſee the very ſame Alterations upon thoſe ſhores. And when you give the Boat the greateſt Motion, you muſt have the higheſt Spring Tides and the loweſt Ebbs. The Waters muſt run directly Eaſt and Weſt, and the Motion muſt begin at the ſame time in all thoſe little Seas. And whatever other Accidents happens in the Flux or Reflux of the Sea, you may plainly ſee, even thoſe Irregular motions (as they are call'd) obſerv'd in the *Euripus* its ſelf (as did

I not think that upon such a motion of the Earth as I have supposed the Reason of those Alterations would manifestly appear, I should have made some words about it.) And the motion of the Waters shall be in Proportion to the largeness of the Vessels, only it shall be insensible in that narrow Vessel that stood North and South in the Boat. Then it will not at all seem strange to you that the Alterations observ'd in other parts of the Ocean are not discernable in the Baltick Sea. And I know that you think it would be the same thing if that Sea was plac't at either of the Poles, or at the Equator: And that if the Mediteranean Sea stood as the Baltick, North and South, that there would be very little or no Tides in that Sea; But to be sure there could be none where now they have the greatest Tides, that is, upon the shores of *Syria*, at *Venice*, and at the Streights mouth. And that if the Baltick Sea was plac't East and west, the tides would be discernable enough in the Extremities of that Sea.

To conclude, I lately met with a couple of Observations about the ebbing and flowing of the Sea in the Philosophical Transactions of the truly Royal Society, not yet spoken of the first is: That the water neither flows nor ebbs alike, in Respect of equal Degrees, but its Velocity increaseth with the tide till just mid-water or half-flood, at which time its Velocity is at the Strongest; and then decreaseth proportionably till high-water or full Sea.

If you have understood what I have said, you cannot but know that the first three hours of every flood and ebb is that three hours time in which the earth is returning to its Level; then the business is to know whether it may be thought that the Moon lets fall the side of the Globe with a Motion somwhat quicker, then she raises it. Or, that the waters falling upon the empty shores, must be thought to rise faster the first three hours, then they can when the shores and Rivers

are

are half full. I must leave this to the Determination of wiser men.

The other Observation is indeed very notable, which is, that the morning tides for one half of the year are higher by a foot (where it flows 8 or 10 foot) then the evening tides; and on the contrary the other half year.

It would trouble a good head to give a Satisfactory Reason how this should happen, if the earth has not such a Motion as I have been speaking of; but that being alow'd, the cause of this odd effect is manifest enough. Nay I am perswaded that the solving of this doubt would give much Reputation to the Hypothesis, but because it would ingage me to speak of things that at this time I do not care for medling with, I shall now let it alone, but if the Learned shall think there is more in what I have already said, then meer Conjecture (as I am under a strong delusion if there be not) then upon some other Occasion you may know more of my thoughts about this. Till that be known, farewel.

FINIS.

To be Sold by *William Gadbury*, without the Bars in *White-Chappel*.